PATENT SPECIFICATION (11) 1 358 345

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(21) Application No. 14604/72 (22) Filed 29 March 1972
(31) Convention Application No. 130 345 (32) Filed 1 April 1971 in
(33) United States of America (US)
(44) Complete Specification published 3 July 1974
(51) International Classification F16L 59/00
E04B 1/62
(52) Index at acceptance
F2X 7D2 7D4 7X7

(19)

(54) INSULATING MATERIAL AND METHODS OF MANUFACTURE

(71) We, JOHNS-MANVILLE CORPORATION, a corporation organized under the laws of the State of New York, United States of America, of 22 East 40th Street, New York, State of New York 10016, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a thermally insulating body comprising fibres bonded togethed to form a resilient blanket, and to to a method of producing such a thermally insulating body.

In the construction of metal buildings, for for example, buildings having corrugated sheet metal walls and roofs, insulating materials with moisture impervious facings are used to line the inside for purposes of insulating the building as well as improving appearance. The roofs of such buildings presented problems when a blanket of glass wool insulation is used. Unless the blanket was supported on close centres, it had a tendency to to sag giving an unsightly appearance. If the facing was to form a moisture impervious surface, tabs extending from the longitudinal margins of the blanket insulation were required to be stapled or glued together. Often a sealing strip was secured over the longitudinal seam between blankets.

One approach for an insulating layer in the above type construction is the use of a rigid or semi-rigid board of felted fibres. Such board has heretofore been cut in relatively short lengths to facilitate handling and shipping. These short lengths require frequent end joints which increase the potential for heat loss and are unattractive. When faced with a sheet of material providing a vapour barrier, and in some instances a decorative finish, the end joints of the facing require additional installation effort and further detract from the final appearance.

According to one aspect of the present invention we provide a thermally insulating body comprising: fibres bonded together to form a resilient primary blanket, said primary blanket having a major face and a longitudinal margin, and an edge strip, a flexible sheet facing means secured to the face of the blanket with a portion extending beyond said longitudinal margin and over at least a part of said edge strip to define a tab, the edge strip lying along said longitudinal margin and extending at least to the longitudinal edge of said tab to protect the tab against physical deformation during handling, a tape generally coextensive with and bonded to said tab to reinforce said tab and to prevent sticking of said edge strip to said tab, said edge strip being adapted for removal from the tab for exposing the tab at a time when said insulating body is installed whereby said tab is adapted to overlie an adjacent insulating body for at least partially sealing the joint therebetween.

According to a second aspect of the invention we provide a method of producing a thermally insulating body comprising: forming fibres into a thermally insulating blanket, slitting the blanket longitudinally at least along one side to form a primary blanket and a removable edge strip with the edge strip remaining in position relative to the primary blanket, applying a flexible sheet facing material over the primary blanket and over at least a part of the width of the edge strip, providing a tape along one longitudinal edge of said sheet facing and bonding said shape to said sheet facing, bonding the flexible sheet facing to the primary blanket, said tape preventing the bonding of said edge strip to said sheet facing, and packaging the resultant insulat-

[Price 25p]

ing body with the edge strip remaining in position to protect its overlying sheet facing from deformation during handling whereby the edge strip is adapted to be removed upon unpackaging and installation to expose the overlying sheet facing reinforced by said tape as a cantilevered portion to define a sealing tab.

The thermally insulating body of the present invention may be used to overcome the above problems by producing the same in the form of a roll of blanket insulation having a length suitable to span a plurality of framing elements and frequently of such length as to extend across an entire building surface. For example in roof installations, the blanket may extend the length of the roof and possess sufficient degree of rigidity to resist sagging between purlins on 4 - 6 foot centres. In addition, the insulating material has a tab of facing material extending from its margin with sufficient stiffness for overlapping an adjacent blanket. This tab is protected in shipping to maintain its shape allowing the blankets to be butted and a relatively impervious seal obtained between blankets without stapling or gluing.

A thermally insulating body is disclosed in the preferred embodiment as a blanket of resin bonded glass fibres having major flat faces with longitudinal margins. The blanket is slit longitudinally along one side just a short distance inward from the edge to define an edge strip which is temporarily held in position by the slit being an incomplete or perforated slit. The edge strip is adapted for physical removal as a later step. The edge strip is at least equal in width to the tab to protect the tab from being crushed or displacement relative to that portion of the facing secured to the primary blanket. The edge strip remains temporarily in position to provide a protective body adjacent the tab.

The primary blanket and edge strip are formed by bonding fibres which are thermally insulating into a blanket, longitudinally slitting the blanket in a perforating manner to form a primary blanket and an edge strip with the edge strip paralleling a longitudinal margin of the blanket. A tab is formed by securing a facing sheet to a major face of the primary blanket and extending the facing sheet over at least a portion of the edge strip to allow the edge strip of blanket to protect the tab during handling.

The tab is reinforced by a tape provided by folding a portion of the facing sheet upon itself or by the use of a supplemental tape. When the latter method is used, the blanket with a thin flexible facing sheet and a supplemental tape is to be bonded to the blanket. The facing and tape are simultaneously applied to the blanket with the tape lying between the facing and the blanket in registry with the edge strip already formed by slitting the blanket along its longitudinal margin. The combination is cured in an oven to set the adhesive and then wound on a mandrel of sufficient diameter to prevent the blanket from obtaining a permanet set to enable it to unroll to a flat form. Since the tape is impervious to the adhesive, it masks the facing from the edge strip making the edge strip removable along the slit when the tab is to be exposed. At the same time, the tape beneath the tab overlaps to the primary blanket by a short distance. The tape also reinforces the tab.

The present insulating blanket eliminates the need for stapling or gluing of tabs to form a vapour barrier as required in the prior art. Use of the tape and protective, disposable, edge strip-like protective portion eliminates wrinkles of the tab to give a better appearance. The degree of rigidity of the blanket by reason of its relative high density eliminates sagging and makes it easier to handle. Appearance is also also enhanced because the flat overlapping tab is hardly discernible giving a smooth finish impression.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a simplified schematic of an elevational view of a line for manufacturing blanket insulation;

Figure 2 is a cross-sectional view taken generally along Line 2-2 of Figure 1 and showing a slitting operation;

Figure 3 is a plan view of the slitting operation of Figure 2 taken generally along Line 3-3 of Figure 1;

Figure 4 is a cross-sectional view taken generally along Line 4-4 of Figure 1;

Figure 4A is a cross-sectional view similar to Figure 4 but showing a different embodiment;

Figure 5 is a fragmentary perspective view of the blanket insulation with cut-away portions to illustrate the disposable edge strip, tape and sheet;

Figure 6 illustrates a roll or package of insulation;

Figure 7 is a fragmentary end-view of rolled insulation for illustrating relative positions of edge strip and tab;

Figure 8 is a segment of a longitudinal cross-section of a roll of insulation illustrating the relative positions of the edge strip and the tab;

Figure 8A is similar to Figure 8 but showing a different embodiment;

Figure 9 illustrates a deformed tab;

Figure 10 illustrates a roll of insulation partially unrolled and showing partial removal of the edge strip to expose the tab;

Figure 11 is a cross-sectional view of a portion of the blanket and tab;

Figure 11A is a cross-sectional view similar to Figure 11 but showing a different embodiment; and

Figure 12 is a perspective view of several strips of insulating material over a roof purlin in side by side relationship.

Referring to Figure 1 a manufacturing line in schematic form is illustrated for the manufacture of blanket insulation of fiber glass wool wherein filaments 10 are formed into elongated glass fibers 12, softened by a flame attenuator 14, and coated with binder by the binder applicator 16 to form a blanket 24 on the chain belt 18. The thickness of the blanket 24 is exaggerated for illustration purposes. The blanket 24 passes between the hot rolls 20 where the surfaces are cured and onto platens 22 where the insulation is cured to the desired thickness. Spaced apart rotary knives 26 trim the edges of the blanket 24 while a slotted disc 27 (Figure 3), turning against a back-up roll (not shown) at a peripheral speed equal to the linear speed of blanket 24, slits the blanket in a perforated manner to form an easily disposable strip-like blanket portion 54 along one longitudinal margin 62 of the blanket. Any other means may be used just so the edge strip is at least partially severed from the blanket for subsequent physical removal. Immersed in an adhesive bath 30 is a roll 32 having a doctor roll 34 for applying adhesive to facing 36 being fed from facing roll 38. As the facing 36 with adhesive thereon is advanced toward the blanket 24, it is joined by tape 40 from roll 42 and both are brought in contact with the blanket 24, at the point of tangency between the blanket 24 and directional roll 44. The combination is passed through an oven 58 where the adhesive is cured to form a bond between the facing 36 and blanket 24 and tape 40 resepectively. A longitudinal portion the facing 36 overhangs the blanket 24 as a cantilevered tab when portion 54 of the blanket formed by the perforated slit is removed. That tab, reinforced by tape 40, can be used to seal butted joints when lengths of blanket 24 are installed side by side. Finally, the blanket 24, including edge strip 54 is wrapped or packaged in rolls 28 about a mandrel 46 to form a convenient handling package.

While the line outlined above produces, in the preferred embodiment, a glass fiber blanket 24 it is to be understood that other materials can be fiberized by the usual means of spinning, drawing, attenuating and blowing for all or part of the insulating blanket. The glass fibers 12 are formed from filaments softened by the flame attenuator 14 to attenuate the filaments into lengths of individual elongated fibers 12. Collection of the fibers 12 on the chain belt 18 results in a build-up to form a blanket on the belt 18 as it is continuously moved around the supporting rolls 48. Sufficient adhesion in the binder, applied by the binder applicator 16 as the fibers 12 are attenuated, exists to maintain the fibers in a loose blanket 24. The blanket 24 is then passed through the hot rolls 20, which are rotated, to cure the surfaces of the major faces of the blanket 24 by virtue of the heat released from the hot rolls 20. In passing between the platens 22 the surface cured blanket 24 is pulled through an opening formed by parallel inner faces of the opposing platens 22 and by applying heat from the platens 22 the blanket is given the desired thickness and cured to retain its shape and give it the desired degree of rigidity. In the utilizations contemplated here, densities of the order of 1 to 2 pounds per cubic foot have been employed in thicknesses of from 1 to 3 inches with sufficient binder to avoid any substantial sag of faced material when supported on five foot centers. Division of blanket 24 into the primary portion 52 and secondary edge strip portion 54, which becomes a readily detachable strip, is accomplished with a slotted circular saw 27 against a backing roll (not shown) to leave readily severable bridges 53 of insulating wool between 52 and 54, see Figure 5.

Although glass fibers are preferred due to their ease of formation and thus economical availability in fine diameters and appropriate lengths, other common materials which can be fiberized as by usual means of spinning, drawing, attenuating, blowing, etc. into fine diameter fiber can be employed exclusively or in part in the formation of the mat. These may include known products manufactured from various source materials of silicates of metal oxides, such as rock wools from argillaceous matter or shale, slag wool from metallurgical slags, each commonly referred to as "mineral wools", aluminum silicate fibers and any fibers of the so-called glasses.

A thin flexible facing 36, fed from the facing roll 38 as illustrated in Figure 1, is placed atop the blanket over its full width. Typical of the facings 36 used are unplasticized films such as chlorinated polyethylene and polyvinyl chloride. Other moisture impervious films may be used. An adhesive bath 30 with a roll 32 rotating in a supply of adhesive in the bath 30 is provided to apply a controlled amount of adhesive to a doctor roll 34 which in turn applies the adhesive to the inner face of the facing 36 before it is joined on the directional roll 44 by the supplemental tape 40, which may be a more flexible vinyl. Tape 40 reinforces tab 60 and prevents adherence of strip portion 54 to facing 36. The tape roll 42

feeds tape 40 onto the directional roll 44 which is rotated to apply facing 36 and tape 40 to the blanket at the point of tangency between the roll 44 and the surface of the blanket 24. Curing of the adhesive to form a bond between the facing 36 and blanket 24 and between the facing 36 and the tape 40 is accomplished by heating the combination in the oven 58. Strip portion 54 is not adhered to facing 36 or tape 40. The blanket insulation, now complete with facing 36 and tape 40, is wrapped around a mandrel 46 which is driven by conventional means, not illustrated, by attaching the leading end of the blanket 24 to the mandrel. The smallest radius of wrap is large enough to prevent a set in the blanket 24 so that the blanket 24 retains its flat shape upon being unrolled. Substantial lengths, for example in excess of one hundred feet, are wound in rolls 28 and then the blanket 24 is transversely severed by a conventional means, not illustrated, e.g. a shear. The rolled blanket 24 is removed from the mandrel and the new leading edge attached to the mandrel 46 to continue the process. Side strip 54 is temporarily held in position under tab 60 by friction therebetween or by its incomplete severance from the primary blanket, or by both. If severance is complete throughout the margin, friction against the tab alone is normally sufficient to hold the strip in temporary position. The edge strip temporarily protects the tab from deformation. It is effective during packaging, such as placing in a roll, and subsequent handling and unrolling for use. The strip is manually removable to expose the tab in cantilevered projection from the primary blanket.

The fabrication and purpose of the blanket 24 when completed with its facing 36 and tape 40 can be better understood by viewing the product as illustrated in FIGURE 5. A fragmentary portion of the blanket 24 is illustrated with its facing 36, tape 40, and secondary edge strip portion 54 of the blanket all cut back for illustrative purposes. The primary portion of the blanket 52 in 1-1/2 inch thickness and 1 pound per cubic foot density, having a facing sheet of 4 mil unplasticized chlorinated polethylene and 3 mil plasticized vinyl tape, will sag only a 1/4 inch when supported on five foot centers because of the degree of rigidity given to the blanket by the curing between the platens 22. This degree of rigidity enables the primary portion 52 of the blanket to support a tab 60 created by the overhang of tape 40 and facing 36 when the secondary portion 54 or detachable strip of blanket 24 is simply broken away along the longitudinal margin 62. The tape 40 offers the advantage that it is impervious to the adhesive on the facing 36 and masks the detachable edge strip 54 from the adhesive to maintain it free for removal. At the same time, the tape 40 overlaps the primary portion 52 and is attached by adhesion to the facing 36 lending reinforcement to the tab in the transverse direction as well as the longitudinal direction of the blanket 24.

The tab 60 is protected from deformation relative to the blanket 24, e.g., bending or wrinkling, by the detachable strip 54 remaining adjacent thereto up until the time of use. By lapping the tab 60 of one blanket over the marginal edge of an adjacent blanket as illustrated in FIG. 12 a moisture barrier between blankets is obtained simply by butting the blankets side-by-side. It is, therefore, important that the tabe 60 be maintined flat prior to assembly in order to form the seal. In addition, the flat tab 60 gives a neat appearance, being hardly discernible.

In the preferred embodiment, plasticized vinyl material having similar expansion and stretching characteristics as the facing 36 is used as the tape 40 to prevent wrinkling of the facing 36 and tab 60. Other flexible materials having similar expansion and stretching properties to plasticized vinyl could be used as the tape 40.

The blanket 24 can be manufactured in any width desired and while 1-1/2 inch thickness is preferred, thicknesses of 1 to 3 inches can be manufactured.

The degree of rigidity and, therefore, the sag of the blanket 24 varies with thickness and density of the blanket. A typical density is one pound per cubic foot. Since rigidity increases with an increase in density, the density can be varied to obtain a desired rigidity.

Facing tabs on more than one of the margins of the blanket could be produced if desired. A blanket with two tabs could be used in a similar manner to the blankets of the prior art by pulling adjacent tabs of butted blankets together along the edges of the longitudinal margin and stapling the tabs.

While the widths of the tab 60 and tape 40 may be varied, in a preferred embodiment, the tab 60 is 2-1/2 inches wide and the width of the tape 40 is 3 inches providing for a 1/2 inch overlap of the tape 40 onto the face of primary portion 52 of the blanket 24.

FIGURE 6 illustrates a rolled package with edge strips rolled therewith. FIGURE 7 which is a fragmentary end view showing edge strip 54 rolled in position against tab 60 for temporarily protecting it by providing a backing or packing mass. Preferably edge strip 54 is not completely severed from main portion 24, but as indicated the wound arrangement would be sufficient to

temporarily retain it in position by friction even if severed. Preferably, strip 54 is slightly wider than tab 60 for providing more protection for the tab.

FIGURE 8 illustrates an enlarged segment of a longitudinal cross-section of a roll of insulation and shows the edge strip 54 extending slightly beyond the edge of the tab 60.

FIGURE 8A is similar to Figure 8, but illustrates an embodiment where the edge strip 54' is left untrimmed to protect the tab 60.

As illustrated in FIGURES 2 and 3, the very side extremity 70 is trimmed away by rotating saws 26 and is immediately discarded as scrap. Slotted circular saw 27 pressing against a back-up roll severs edge strip 54 in a manner previously discussed. FIGURE 4 illustrates the substantially completed product further down the forming line as illustrated in FIGURE 1 generally along Line 4-4 prior to being rolled into a package.

An equally preferred, and possibly more economical, form of the invention is illustrated in FIGURE 4A. Herein it will be noted that only one side extremity of blanket 24 has been trimmed away, i.e., at side 71. The other side extremity is not trimmed by a saw 26 as before and the side remains unsevered. In this alternate embodiment, as illustrated in the cross-sectional view of FIGURE 4A, it will be noted that an edge strip 54' underlies tab 60 for the purpose previously described. Its untrimmed side remains protruding therefrom to provide greater endwise protection for tab 60. In this embodiment, the margin 62 is slit as before so that edge strip 54' can be removed at time of installation.

FIGURE 10 illustrates a roll of packaged insulation in the process of being unrolled with strip 54 being pulled from its position to expose tab 60. Without the benefit of strip 54 or 54' during handling, it is obvious that endwise force on the tab of the insulalation, whether in package form or not, would cause physical deformation as indicated in FIGURE 9. This, of course, would intefere with its appearance and sealing efficiency.

As previously indicated, sagging of a panel of insulation supported on 5 foot centers is a minor, in the range of 1/4 inch. With tape reinforcing tab 60, sag at the tab will be even less thereby resulting in the tab being pulled closer onto the adjacent panel.

The purpose of tape 40 and the method by which it was installed have been previously disclosed in this specification. Another embodiment of tab 60 is illustrated in FIGURE 11A where a portion of facing 36 is folded back over itself for purposes of strengthening the tab and for preventing adhesive from coming into contact with the fibers of edge strip 54 or 54'. In this forming process as illustrated in FIGURE 1, tape 40 from roll 42 would be eliminated and sheet facing 36 would have a portion at its edge folded upon itself after adhesive is applied and prior to coming in contact with blanket 24. It will be noted that since the facing is impervious to the adhesive no adhesive will come into contact with the fibers of edge strip 54, 54'.

Advantages of the insulating bracket include its non-sagging degree of rigidity, its convenient roll packaging, and its protected integral tab 60. There is an elimination of the stapling requirement of the prior art blankets or the separate taping of joints between rigid blankets. The smooth flat tab 60 can form a substantial moisture barrier by simply overlapping an adjacent butted blanket 24. The need of additional supports to overcome the sag of blankets of the prior art is also eliminated. The overlap of the tab 60 conceals the butted joint between blankets and gives the impression that a series of blankets 24 joined together are a single smooth surface. Handling of the blanket 24 is also enhanced by the degree of rigidity of the blanket making it easier to handle and to position.

It is to be understood that the detailed embodiment of the invention described above lends itself to modification including changes in materials, the physical characteristics and the form of the insulating system. Thus, the overhanging facing utilized as a seam closing tab can be utilized in flat packaged insulating board where a protective, disposable strip is provided. Accordingly, it should be appreciated that the above disclosure is to be read as illustrative and not in a limiting sense.

WHAT WE CLAIM IS:—

1. A thermally insulating body comprising: fibres bonded together to form a resilient primary blanket, said primary blanket having a major face and a longitudinal margin, and an edge strip, a flexible sheet facing means secured to the face of the blanket with a portion extending beyond said longitudinal margin and over at least a part of said edge strip to define a tab, the edge strip lying along said longitudinal margin and extending at least to the longitudinal edge of said tab to protect the tab against physical deformation during handling, a tape generally coextensive with and bonded to said tab to reinforce said tab and to prevent sticking of said edge strip to said tab, said edge strip being adapted for removal from the tab for exposing the tab at a time when said insulating body is installed whereby said tab is adapted to overlie an adjacent insulating body for

at least partially sealing the joint therebetween.

2. A thermally insulating body according to Claim 1 wherein the edge strip is at least partially severed from the primary blanket at the longitudinal margin.

3. A thermally insulating body according to Claim 1 wherein the edge strip is completely severed from the primary blanket at the longitudinal margin.

4. A thermally insulating body according to any one of Claims 1-3 wherein the edge strip is retained generally coextensive with the tab by a frictional engagement therewith when the insulating body is in a rolled package.

5. A thermally insulating body according to any one of Claims 1-4 wherein said flexible sheet facing means is impervious for defining a vapour barrier.

6. A thermally insulating body according to any one of Claims 1-5 wherein said flexible sheet facing means is bonded to the major face of the blanket.

7. A thermally insulating body according to any one of Claims 1-6 wherein the width of said tape is slightly greater than the width of said tab.

8. A thermally insulating body according to any one of Claims 1-6 wherein said tape has a width coextensive with the tab width.

9. A thermally insulating body according to any one of Claims 1-8 wherein said tape is constituted by a portion of a longitudinal edge of said flexible sheet facing means which is folded, upon itself.

10. A thermally insulating body according to any one of Claims 1-8 wherein said tape is separate from said flexible sheet facing means.

11. A method of producing a thermally insulating body comprising: forming fibres into a thermally insulating blanket, slitting the blanket longitudinally at least along one side to form a primary blanket and a removable edge strip with the edge strip remaining in position relative to the primary blanket, applying a flexible sheet facing material over the primary blanket and over at least a part of the width of the edge strip, providing a tape along one longitudinal edge of said sheet facing and bonding said tape to said sheet facing, bonding the flexible sheet facing to the primary blanket, said tape preventing the bonding of said edge strip to said sheet facing, and packaging the resultant insulating body with the edge strip remaining in position to protect its overlying sheet facing from deformation during handling whereby the edge strip is adapted to be removed upon unpackaging and installation to expose the overlying sheet facing reinforced by said tape as a cantilevered portion to define a sealing tab.

12. A method according to Claim 11 wherein the slitting step completely severs the edge strip from the primary blanket.

13. A method according to Claim 11 or Claim 12 wherein said tape is provided by folding a portion of a longitudinal edge of said sheet facing upon itself.

14. A method according to Claim 11 or Claim 12 wherein said tape is separate from said sheet facing.

15. A thermally insulating body substantially as hereinbefore described with reference to and as shown in Figures 1 to 11, or Figures 1 to 11 as modified by Figure 4*A*, Figure 8*A* or Figure 11*A*, of the accompanying drawings.

16. A method as claimed in Claim 11 and substantially as hereinbefore described with reference to Figures 1 to 11, or Figures 1 to 11 as modified by Figure 4*A*, Figure 8*A* or Figure 11*A*, of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1974
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1358345 COMPLETE SPECIFICATION
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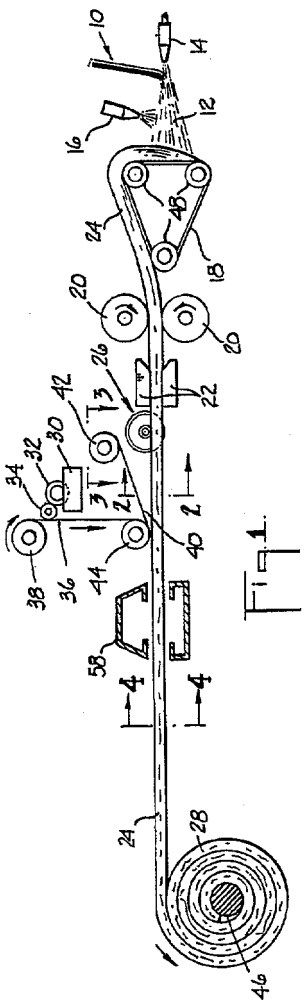

Fig. 1.

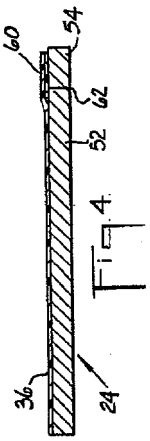

Fig. 4.

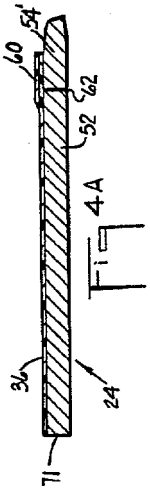

Fig. 4A

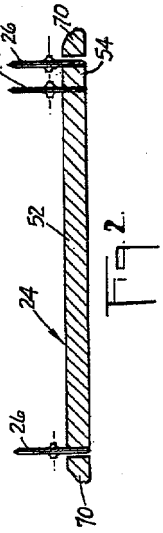

Fig. 2.

1358345 COMPLETE SPECIFICATION

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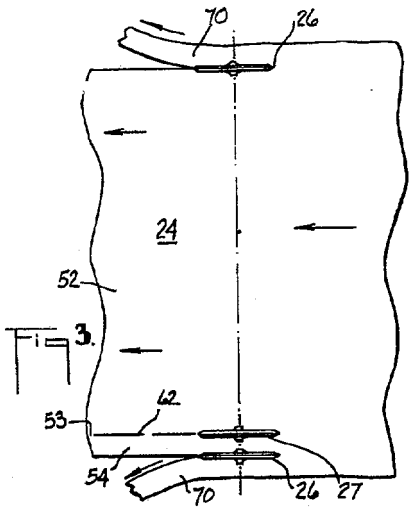

Fig. 3.

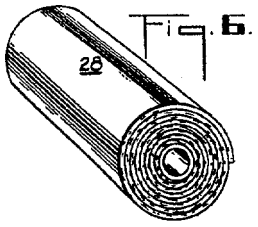

Fig. 6.

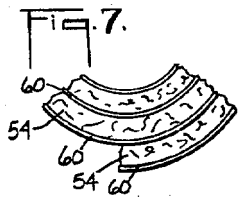

Fig. 7.

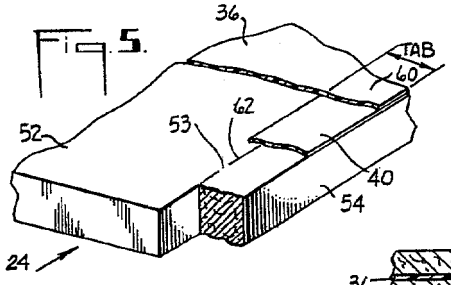

Fig. 5.

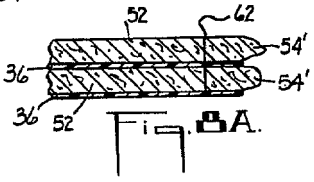

Fig. 8A.

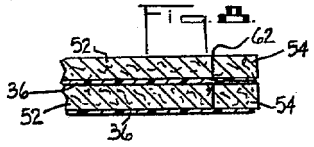

Fig. 8.

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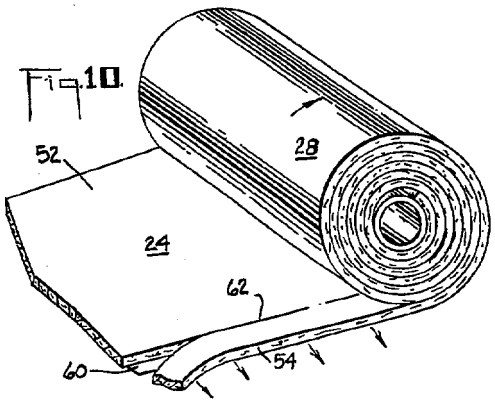
Fig.10.



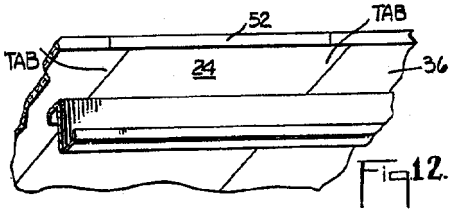


Fig.12.

Fig.9.

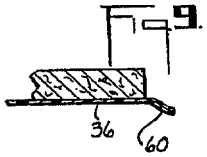
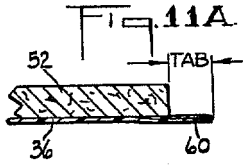


Fig.11A.



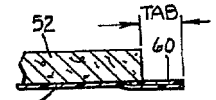


Fig.11.